Title: Unfair M&M's

Brief Overview:

Students will explore a real life application of fractions and percents by collecting and interpreting data to compare the color distribution in M&M's candies. Students will use a variety of graphs, charts and technology to write a persuasive letter to the M&M factory to change their candy color distribution.

Links to NCTM 2000 Standards:

- **Standard 1: Number and Operation**
  Mathematics instructional programs should foster the development of number and operation sense so that all students understand numbers, ways of representing numbers, relationships among numbers, and number systems; understand the meaning of operations and how they relate to each other; and use computational tools and strategies fluently and estimate appropriately. Students will estimate and represent numbers as fractions and percents to analyze data. They will use the data to compare the distribution of colors in individual bags of M&M's to the actual factory distribution posted on the Internet.

- **Standard 5: Data Analysis, Statistics, and Probability**
  Mathematics instructional programs should include attention to data analysis, statistics, and probability so that all students pose questions and collect, organize, and represent data to answer those questions; interpret data using methods of exploratory data analysis; and develop and evaluate inferences, predictions, and arguments that are based on data; Students will collect, organize and represent data using M&M candies in order to answer stance questions and develop a persuasive argument. The data will be displayed using various types of tables and graphs to help support an argument.

- **Standard 6: Problem Solving**
  Mathematics instructional programs should focus on solving problems as part of understanding mathematics so that all students develop a disposition to formulate, represent, abstract, and generalize in situations within and outside mathematics; apply a wide variety of strategies to solve problems and adapt the strategies to new situations; and monitor and reflect on their mathematical thinking in solving problems. Students will use data (fractions of their favorite colors) to determine the amount of each color needed in a class bag of M&M's. They also will use problem solving as they analyze data to construct a persuasive letter.

- **Standard 7: Reasoning and Proof**
  Mathematics instructional programs should focus on learning to reason and construct proofs as part of understanding mathematics so that all students recognize reasoning and proof as essential and powerful parts of mathematics; make and investigate mathematical conjectures; develop and evaluate mathematical arguments and proofs; and select and use various types of reasoning and methods of proof as appropriate. Students will represent numbers as fractions and percents to analyze data. They will use the data to compare the distribution of colors in individual bags of M&M's to the actual factory distribution posted on the Internet.

- **Standard 8: Communication**
  Mathematics instructional programs should use communication to foster an understanding of mathematics so that all students organize and consolidate their mathematical thinking to communicate with others; express mathematical ideas coherently and clearly to peers, teachers, and others; extend their mathematical knowledge by considering the thinking and strategies of others; and use the language of mathematics as a precise means of mathematical expression. Students will use reasoning by writing to persuade the M&M factory to change the distribution of colors in the M&M bags after analyzing and interpreting data. They will use their data to answer a variety of stance questions to demonstrate their understanding.

- **Standard 9: Connections**
  Mathematics instructional programs should emphasize connections to foster an understanding of mathematics so that all students recognize and use connections among different mathematical ideas; understand how mathematical ideas build on one another to produce a coherent whole; and recognize, use, and learn about mathematics in contexts outside of mathematics. Students will make connections between tables, graphs, fractions and percents through oral and written responses. They will write to persuade the M&M factory to change the distribution of colors in the M&M bags.

Grade/Level:

Grades 4-5

Duration/Length:

3-4 class periods, 50 minutes each

Prerequisite Knowledge:

Students should have working knowledge of the following skills:

- Estimating
- Constructing fractions
- Converting fractions into percents
- Converting percentages to fractions
- Constructing and interpreting a table (frequency table)
- Constructing and interpreting graphs (bar graph, pictograph, pie graph, line graph)
- Writing to persuade
- Writing in business letter format

Student Outcomes:

Students will:

- apply estimation strategies to solve problems and to determine the reasonableness of results.
- collect, analyze, and interpret data by creating tables.
- compare collected data to actual data found on the Internet.
- convert fractions to percents, and find percents of numbers.
- analyze data to make and evaluate inferences and apply to a real-life situation.
- use data to support an argument by writing to persuade in business letter format.
- find place value of numbers to the hundredths.

Materials/Resources/Printed Materials:

- Individual M&M packets (enough for each student)
- Colored pencils or crayons
- Calculators - One per student
- M&M picture for students to color and place on pictograph
- Scissors
- Masking tape
- Student Resource Sheets # 1-14
- Teacher Resource Sheets
- Internet website - **http://www.mars.com**
- Internet website - **http://www.m-ms.com/factory/history/faq1.html**
- Internet website - **http://www.m-ms.com/colorworks/picker.html**

Development/Procedures:

Day 1

- Present the following situation to the class:
- "How many of you believe that when you get your bag of M&M's, it will contain the exact same amount of M&M's as everyone else in the class?" Show tally on blackboard.
- "How many of you believe that your bag has equal amounts of each color? Explain why you feel the way you do."
- Hand out **Student Resource Sheet 1, Picto Man.** Conduct a survey on their favorite M&M copy. Ask students to color in **Picto Man** in their favorite M&M color. (blue, red, brown, green, orange, yellow) Students will then cut out their Picto Man and tape it onto a pictograph chart on the board. Next, have students total each column and find the fractional value of the class favorites. Students will then transfer this information into a frequency chart of their own located on **Student Resource Sheet 2, Class Tally of Favorite Color of M&M's.**
- Hand each child an individual bag of M&M's. (Don't open them yet!)
- Each child will complete an estimate of colors in their own bag and record their estimates on **Student Resource Sheet 3, What Colors Are Your M&M's?**
- Each child then opens their own bag and proceeds to count out their M&M's (Without eating them!) They then record the frequency of each color onto **Student Resource Sheet 3, What Colors Are Your M&M's?**
- Discuss the possible reasons as to why people have different results.
- Now have children place their own bag of M&M's into a fraction by color, making sure they use their total number. For example if they had 8 red M&M's out of a bag of 32 then, the fraction would be 8/32.
- Children will then take their fraction and create a percentage by dividing the denominator into the numerator. They must round to the nearest hundredths. For example, 8/32 would be 8 divided by 32 = 0.241. Rounded to the nearest hundredths = 0.24. Have children use their calculator. A self check would be if their percentages add up to around 100%.
- Children then take their paper and results to the computer.
- Log on to **http://www.m-ms.com.factory/history/faq1.html**
- Discuss the factory data that is presented in a pie graph. Ask children to compare their answers, in percents, to the percents given on the website. Have them discuss possible reasons for differences in the results.
- Students will then return to their seat and complete the stance questions located on **Student Resource Sheet 4, M&M Mystery.**
- You can check the M&M Mystery the same day or as homework the next day.

Day 2

- Motivation - Ask "Have you ever wanted to see another color in the M&M candies? What colors would you want in there?" Allow time for students to respond.
- "Well, I'm about to make your wish come true!"
- Introduce students to M&M colorworks by logging on to **http://www.m-ms.com/colorworks/picker.html.**
- Allow them to look at the 21 color M&M display (colors are white, black, gray, gold, brown, red, green, orange, yellow, blue, light blue, pink, dark green, teal green, aqua blue, dark blue, purple, light purple, dark pink, cream, maroon).
- Have students chose their favorite Colorworks color. Keep a tally on the board. After all the students have shared, erase all but the top 6 colors. Now students vote again.
- Pass out **Student Resource Sheet 5, Class Tally of Favorite Colorworks M&M's.**
- Students use the Student Resource Sheet # 4 to tally the favorite colors of the class and convert data into a frequency chart (table). Then place each color into a fraction.
- Students then use their fractions to complete **Student Resource Sheet 6, What's Our Bag?**
- **Teacher note:** Depending on the number of students in your class that day, choose the number of M&M's in the bag. You want to make it multiples of the number of students in your class to make it fraction friendly. For example, if you have 15 students that day, make it a bag of 30, 60 or 90 M&M's. Model the first few colors and then allow students to try individually.
- Pass out **Student Resource Sheet 7, Picky Diva's.** Students must use percents to convert to a fraction.
- **Teacher Answers -**

35% - Black 28/80	**10% - Pink 8/80**
25% - Cream 20/80	**5% - Teal Green 4/80**
20% - Light Blue 16/80	**5% - Purple 4/80**

Day 3

- Motivate your students by telling them that they will have the opportunity to write a letter to the M&M factory to persuade them to change the mix in each bag of M&M's.
- Pass out **Student Resource Sheets 8 - 14, Vignette Make it Fair, Rockin' Rubric, Groovy Graphic Organizer, Horizontal Bar Graph Template, Pie Graph Template, Line Graph Template, Business Letter Format.**
- Read aloud the Vignette and complete the **F**orm **A**udience **T**opic **P**urpose.
- Review business letter format with the children and present them with the rubric (an overhead of the rubric would be nice for the students to continually refer to). Stress that their letter should include the following:
    - Two different types of graphs, to include all parts of a graph, to support their claim that the M&M's are unequal.
    - They must use correct business letter format.
    - They must use purposeful and accurate information to fully explain their claim that the M&M's are unequal.
    - They must use correct grammar, spelling, and punctuation.
- Allow students to work on their **Groovy Graphic Organizer** to help formulate their argument. They will then need to construct **2 different types** of graphs with **all** necessary items using their crayons and **their own data!**
- Next the students will need to transfer their information to their business letter. Remind students that they must support their argument with purposeful and accurate information. This is a good time to go back over the Vignette so the students stay focused.
- The rubric is provided for your final writing prompt.

Performance Assessment:

The assessment for this mini-unit will be ongoing. The students will be assessed on participation, completion of daily worksheets, completion of stance questions, ability to work in both cooperative groups and on their own, and the Day 3 Assessment Vignette. A rubric is provided for scoring the final writing prompt.

Extension/Follow Up:

- Students could make a **fraction** book similar to *The M&M Counting Book* by Barbara Barbieri McGrath
- Students could use weights and measurements to weigh M&M's, either individually or by bag. They will also see that not all of the M&M's are the same size which will start a debate.
- Students can write to persuade the factory to make M&M packets according to their class favorites. (instead of equal amounts of each)
- Students can take their individual results and add them together, then compare those results to that of the factory.
- Students can compare the percentages in the almond M&M's and the peanut M&M's.
- List or describe possible extensions or follow-up activities for your unit. Don't go into great detail unless absolutely necessary. Refer back to the website from Day 1.
- There are several M&M recipes on the website that involve fractions. You can double or triple the recipe and have the students make the conversions.

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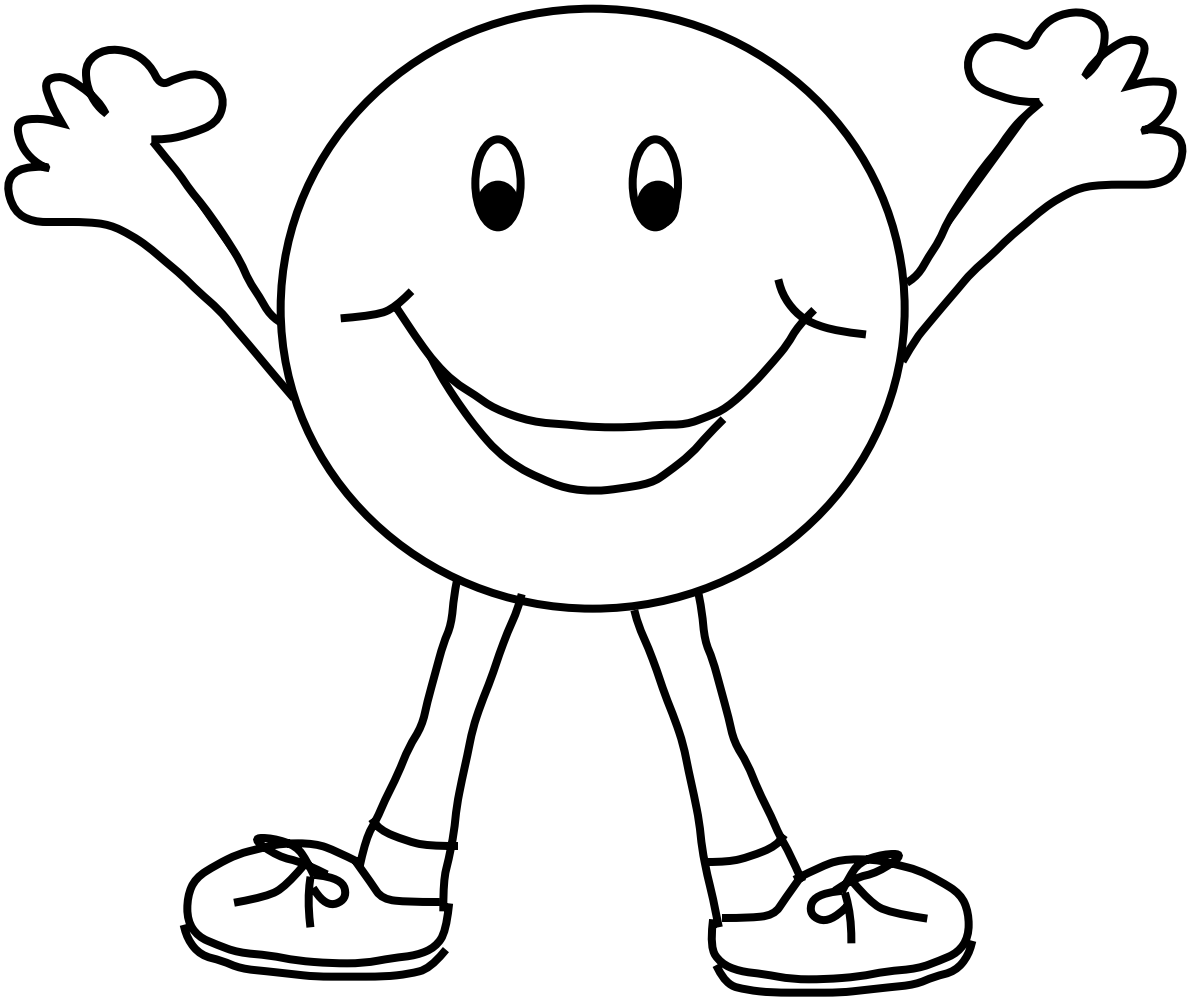
PICTO MAN



Class Tally of *Favorite Color* M & M's

_____ students in the class today !

Colors	Tally	Frequency	Fraction
Red			
Orange			
Yellow			
Green			
Blue			
Brown			

What *Colors* Are Your M & M's ?

_____ **M&M's are in my bag**

Colors	Estimate	Actual	Fraction	Percent
Red				
Orange				
Yellow				
Green				
Blue				
Brown				

M&M Mystery

Answer the following questions in complete sentences. Be sure to include details and examples (your data) to support your answers.

1. Compare your results (percents) to the actual M&M factory percents for each color.

_____

_____

_____

2. Explain why your results are similar or different from the factory percentages.

_____

_____

_____

3. Explain why you think the M&M factory uses different amounts of each color.

_____

_____

_____

4. Explain how you converted the fractions into percents.

_____

_____

_____

Class Tally of *Favorite Colorworks* M & M's

_____ **students in the class today !**

Colors	Tally	Frequency	Fraction

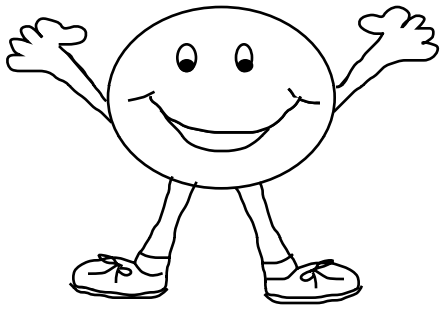
What's Our Bag?

You have just determined the six favorite Colorworks colors of your class. Use the information you collected and the space below to determine the amount of each M&M color you would need to make a class bag containing a total of _____ M&M's.

Picky Divas

As a part of their contract, the Upstreat Girls request that they have the following mix of M&M Colorworks colors in their dressing rooms after each concert:

35% Black
25% Cream
20% Light Blue
10% Pink
5% Purple
5% Teal Green

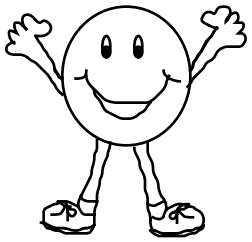


Using this information, determine the amount of each color M&M you would need to mix in a bag of 80 M&M's. You may wish to make a chart to help you organize your information.

Make It Fair!

After discovering the unequal distribution of the colors in the M&M bags, your class decides to write the M&M factory to persuade them to change the percent of M&M colors to make the colors in each bag equal. Using the data you collected from Day 1, write to persuade the M&M factory, in business letter format, to change their color distribution. Your letter should include:

- Two types of graphs to support your claim that the M&M's colors are unequal.
- Purposeful and accurate information to explain your claim that M&M's colors are unequal and persuade the M&M factory to change their distribution of colors.
- Correct business letter format
- Correct grammar, spelling and punctuation



F: _____

A: _____

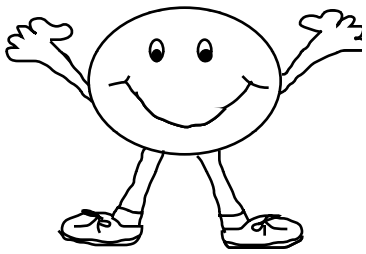
T: _____

P: _____

Rockin' Rubric

4 points

- Uses two different types of graphs (including all parts of a graph) to support argument.
- Uses purposeful and accurate information.
- Uses correct business letter format.
- Uses correct grammar, spelling, and punctuation.



3 points

- Uses two different types of graphs (including most of the parts of a graph) to support argument.
- Frequently uses purposeful and accurate information.
- Frequently uses correct business letter format.
- Frequently uses correct grammar, spelling, and punctuation.

2 points

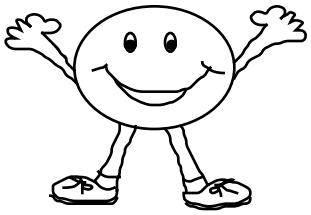
- Uses two types of graphs (includes the parts of a graph sometimes) to support argument.
- Sometimes uses purposeful and accurate information.
- Sometimes uses correct business letter format.
- Sometimes uses correct grammar, spelling, and punctuation.

1 Point

- Uses one type of graph (includes parts of a graph sometimes) to support argument.
- Rarely uses purposeful and accurate information.
- Rarely uses correct business format.
- Rarely uses correct grammar, spelling, and punctuation.

0 Points

- None of the criteria are met.



Groovy Graphic

Opinion

Reason

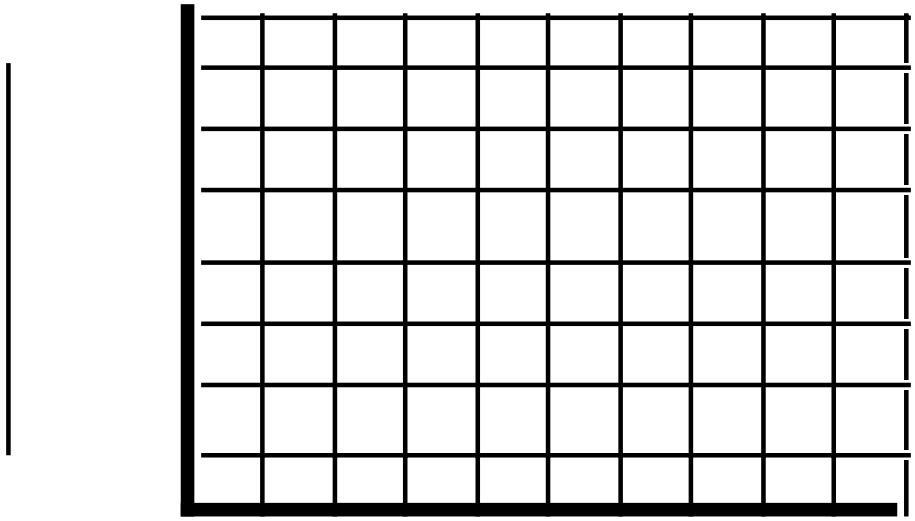
Reason 2

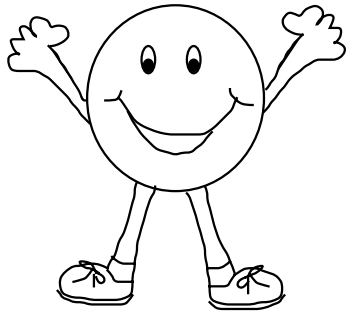
Reason 3

Horizontal Bar Graph Template

Use the given data to construct a bar graph. Be sure your bar graph contains: a title, appropriate labels and a key if necessary.

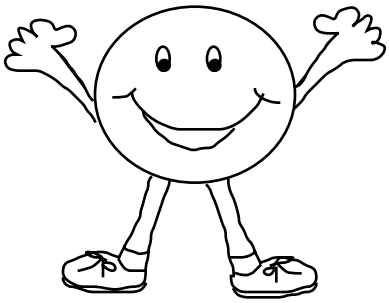
TITLE

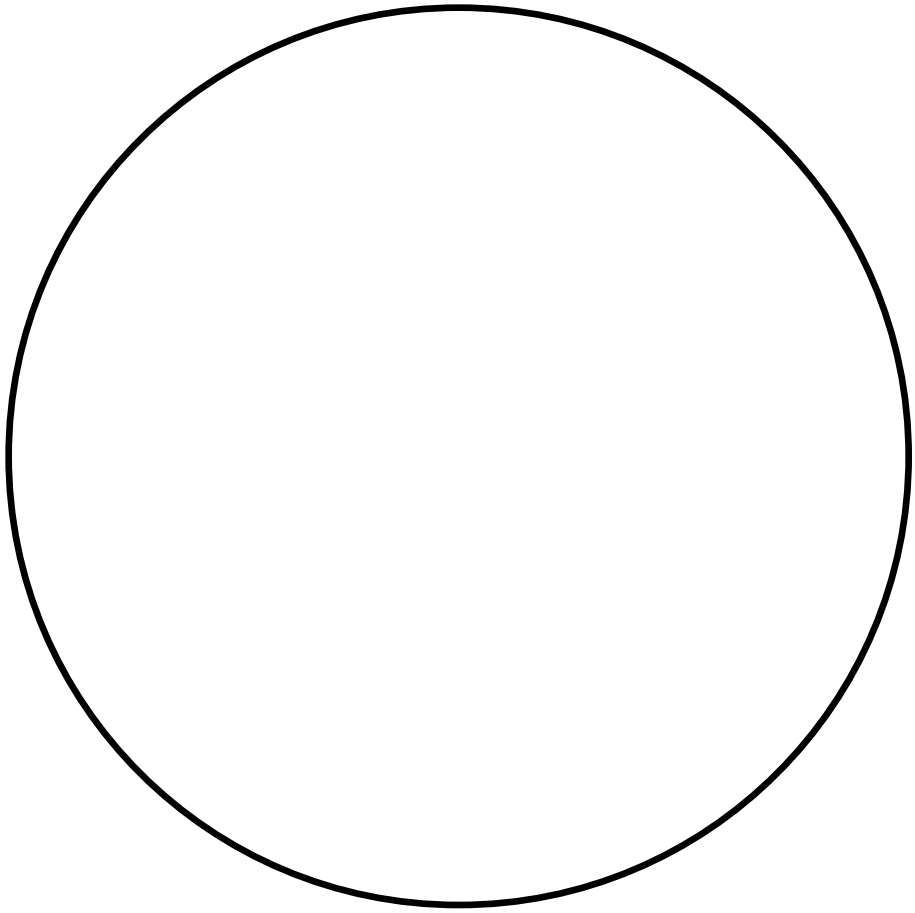




Three statements I can make about this data are:

Circle Graph





I notice that _____

_____

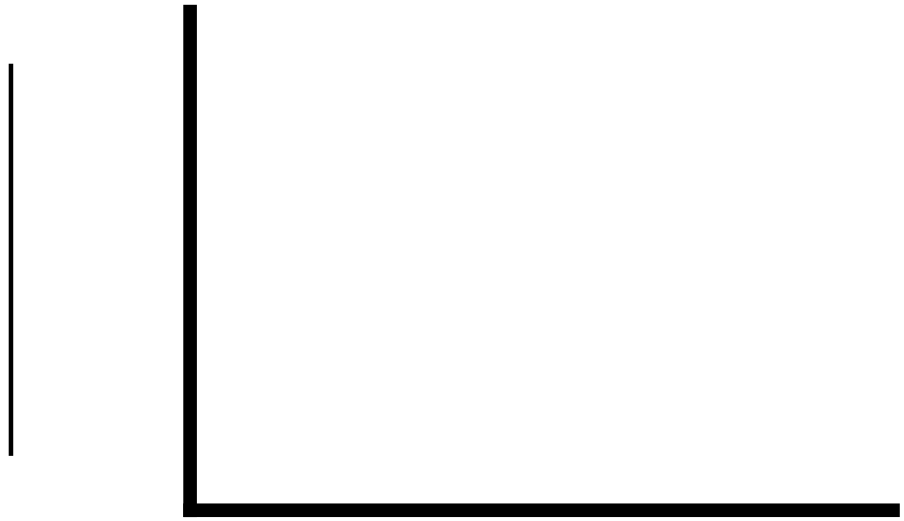
_____

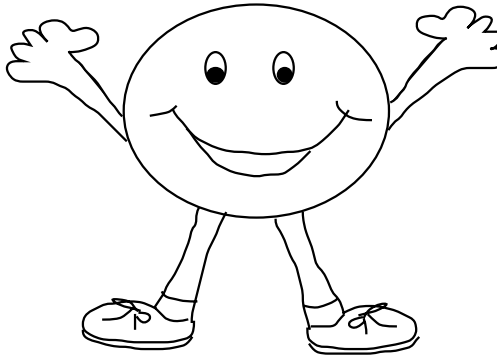
_____

Line Graph Template

Use the given data to construct a line graph

TITLE





Three statements I can make about this data are:

_____

_____

_____

President of M&M*Mars
Division of Mars, Inc.
Hackettstown, N.J. 07840-1503

Dear _____:

_____

_____

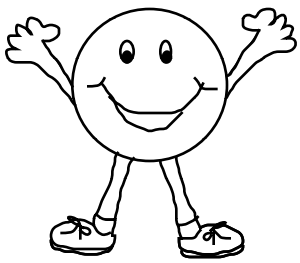
_____

_____

_____

_____

_____



_____,

_____